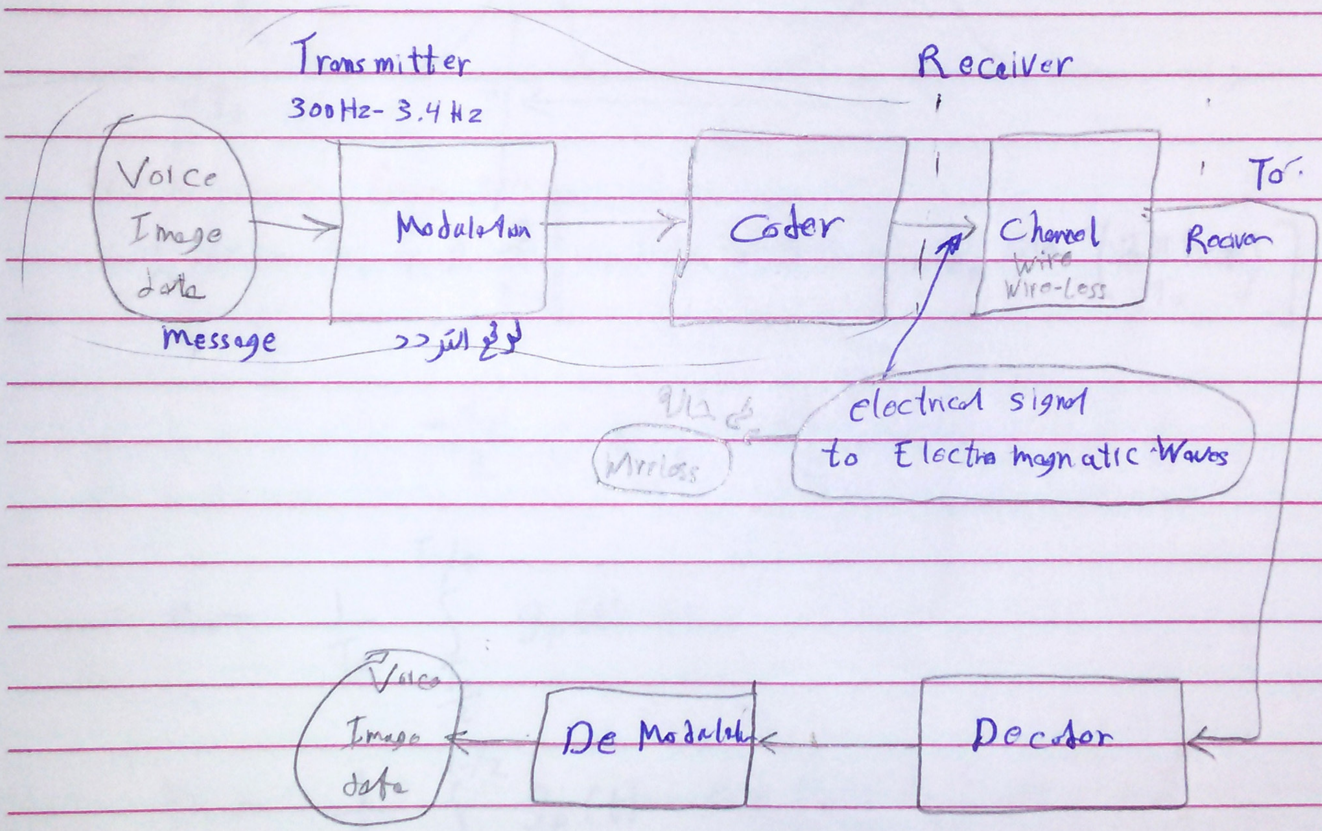
Communication systems

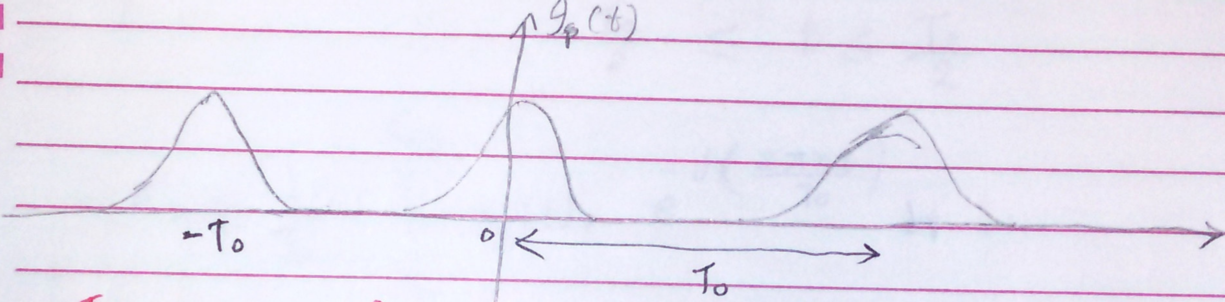
1. Signal and systems
2. Amplitude Modulation (AM)
3. Angle Modulation (PM, FM)
4. Transmission Media



Chapter 1 : Signals and systems

$\boxed{1}$ Fourier series :

- يمكن من خلالها التعبير عن أي Periodic Signal من خلال Sine, Cosine



Trig geometric fourier series

$$g_p(t) = a_0 + 2\sum_{n=1}^{\infty}\left[a_n \cos\left(\frac{2\pi n}{T_0}t\right) + b_n \sin\left(\frac{2\pi n}{T_0}t\right)\right]$$

$$\frac{-T_0}{2} \leq t \leq \frac{T_0}{2}$$

$$a_0 = \frac{1}{T_0}\int_{-\frac{T_0}{2}}^{T_0/2} g_p(t)\,dt$$

$$a_n = \frac{1}{T_0}\int_{-\frac{T_0}{2}}^{T_0/2} g_p(t)\cdot\cos\left(\frac{2\pi n t}{T_0}\right)dt$$

$$b_n = \frac{1}{T_0}\int_{-\frac{T_0}{2}}^{T_0/2} g_p(t)\cdot\sin\left(\frac{2\pi n t}{T_0}\right)dt$$

even $\rightarrow$ $a_n = \checkmark$ $\quad b_n = 0$

odd $\rightarrow$ $a_n = 0$ $\quad b_n = \checkmark$

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Expenintial Fourier Series :

$$g_p(t) = \sum_{n=-\infty}^{\infty} C_n \, e^{j\frac{2\pi n t}{T_0}}$$

$$-\frac{T_0}{2} \leq t \leq \frac{T_0}{2}$$

$$C_n = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} g_p(t) \cdot e^{-j\left(\frac{2\pi n t}{T_0}\right)} dt$$

Dirichlets Condition:

شرط لابد من تحققه حتى يمكن إستخدام Fourier

① The function $g_p(t)$ has single valued within T_0

② Integrable absolutely $\int_{-T_0/2}^{T_0/2} |g_p(t)| \, dt < \infty$

③ $g_p(t)$ has a finite number of maximum and minimum

حساب القدرة بإستخدام Fourier Series

$\boxed{R = 1\Omega}$ القدرة محسوبة بفرض أن

$g_p(t)$ للتعبير عن تيار و جهد

$$P_{avg.} = \sum_{n=-\infty}^{\infty} |C_n|^2$$

Parseval's ~~Parseval's~~ theorem

الإجابة

$$P = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} |g_p(t)|^2 \, dt$$

$$g_p(t) = \sum_{-\infty}^{\infty} C_n \, e^{j\frac{2\pi n t}{T_0}}$$

$$|g_p(t)|^2 = g_p(t) \cdot g_p^*(t)$$

$$P = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} g_p^*(t) \cdot \sum_{n=-\infty}^{\infty} c_n \, e^{j\frac{2\pi n t}{T_0}} \, dt$$

$$P = \frac{1}{T_0} \sum_{-\infty}^{\infty} c_n \int_{-T_0/2}^{T_0/2} g_p^*(t) \cdot e^{j\frac{2\pi n t}{T_0}} \, dt$$

$$c_n = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} g_p(t) \, e^{-j\frac{2\pi n t}{T_0}} \, dt$$

$$c_n^* = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} g_p^*(t) \, e^{j\frac{2\pi n t}{T_0}} \, dt$$

$$\boxed{P = \sum_{-\infty}^{\infty} c_n \cdot c_n^*}$$

$$\boxed{P = \sum_{-\infty}^{\infty} |c_n|^2}$$

في حال وجود مقاومة

إذا $g_p(t) \rightarrow$ جهد

$$P = \frac{P}{R}$$

$g_p(t) \rightarrow$ تيار

$$\boxed{P = P \cdot R}$$